POSITAL
FRABA

ABSOLUTE IXARC ROTARY ENCODER WITH PROFIBUS-DP-INTERFACE
USER MANUAL

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1 General 4

1.1 Absolute Rotary Encoder 4

1.2 Profibus technology 4

2 Installation 5

2.1 Settings in the connection cap 5

2.1.1 Station address 5

2.1.2 Bus termination 5

2.2 Connecting bus lines and power supply 6

2.3 Connecting-up the connection cap with cable glands 7

2.4 Assignment for M12 connectors (AH58-B1DP-072) 8

2.5 Connecting the screen 9

2.6 Instructions for mechanical installation and electrical connection of the angular encoder 9

3 Device Configuration 10

3.1 Overview – Configuration principle 10

3.2 Overview encoder configurations - functionality 11

3.3 Encoder configurations - data format 12

4 Class 1 and Class 2 profile 13

4.1 Parameter settings 13

4.1.1 Code sequence 14

4.1.2 Class 2 functionality 14

4.1.3 Commissioning diagnostics 14

4.1.4 Scaling function 14

4.1.5 Measuring units per revolution 14

4.1.6 Total measuring range 15

4.2 Data exchange in normal operation 16

4.2.1 Transferring the process value 16

4.2.2 Preset function 16

5 Special versions FRABA 2.1 and 2.2 18

5.1 Parameter 19

5.1.1 Activate manufacturer-specific parameters 19

5.1.2 Desired measuring units 19

5.1.3 Desired Measuring units reference 20

5.1.4 Activate commissioning mode 21

5.1.5 Shorter Diagnostics 21

5.1.6 Software-limit switch 21

5.1.7 Physical impulses 22

5.1.8 Encoder type 23

5.1.9 Velocity time base 23

5.2 Data exchange in normal operation 24

5.3 Commissioning mode 25

5.3.1 Setting the counting direction 25

5.3.2 Teach-In Start 26

5.3.3 Teach-In Stop 26

5.3.4 Preset value 27

6 Diagnostic messages 28

6.1 Overview 28

6.2 Supported diagnostic messages 29

6.2.1 Extended diagnostics header 29

6.2.2 Memory error 29

6.2.3 Operating status 29

6.2.4 Encoder type 29

6.2.5 Singleturn resolution 29

6.2.6 Number of revolutions 29

6.2.7 Operating time warning 29

6.2.8 Profile version 29

6.2.9 Software version 29

6.2.10 Operating time 29

6.2.11 Zero offset 30

6.2.12 Programmed resolution 30

6.2.13 Programmed total resolution 30

6.2.14 Serial number 30

6.3 Status indication by the LEDs in the connection cap 31

7 Configuring with STEP 7 32

7.1 Installing the GSD file 32

7.2 Configuring the encoder 33

7.3 Selecting the encoder version 34

7.4 Setting the parameters 35

8 Technical Data 38
8.1 Electrical Data 38
8.2 Certificates 38
8.3 Mechanical Data 39
8.4 Environmental Conditions 39
9 Dimensioned Drawings 40
10 Appendix 42
10.1 Type designation / ordering code 42
10.2 Further encoder configurations 44
10.2.1 Version FRABA 2.0 Multiturn 44
10.2.2 Version FRABA 1.1 Multiturn 44
10.2.3 Version FRABA 1.0 Multiturn 44
10.2.4 Class 2 Multiturn ‚DX-Version' 44
10.3 FAQ absolute encoder Profibus 45
10.4 Definitions 46
11 Index 48
12 Revision index 49

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Author: Reiner Baetjer

1 General

This manual describes installation and configuration of the Absolute Rotary Encoder with Profibus DP interface. The device meets the requirements of a Profibus Slave according to the PROFIBUS standard. It is certified by the “Profibus Nutzerorganisation” in Germany.

1.1 Absolute Rotary Encoder

Basic principle of the absolute measurement is the optical scanning of a transparent disk with code print. The code disk is connected to the shaft that is to be measured. By evaluating the code and two additional incremental signals the absolute position of the shaft can be determined with a resolution of up to 65536 steps per revolution (16 bits).
So-called Multiturn-devices use reduction gears and further code disks to determine the absolute shaft position over up to 16384 revolutions (14 bits).
The position value is calculated in an integrated microprocessor and transmitted over the Profibus.

Further information about the basic function principle of Absolute Rotary Encoders and Profibus networks can be found on our homepage under http://www.posital.com/en/products/rotary-encoders/rotary_encoders_1.php?sl

1.2 Profibus technology

PROFIBUS is an international, open, non-proprietary Fieldbus standard which is defined in the international standards EN 50170 and EN 50254. There are three different versions: Profibus DP, Profibus-FMS and Profibus-PA. FRABA absolute encoders are designed for the DP version. They support all usual baud rates up to 12 MBaud.
Besides manufacturer-specific functions, the devices support the classes 1 and 2 according to the Profile for Absolute Encoders (this device profile can be ordered under part number 3.062 from the “Profibus Nutzeroganisation”). Further information about Profibus (functionality, manufacturer, products), standards and device profiles are available from the PNO:

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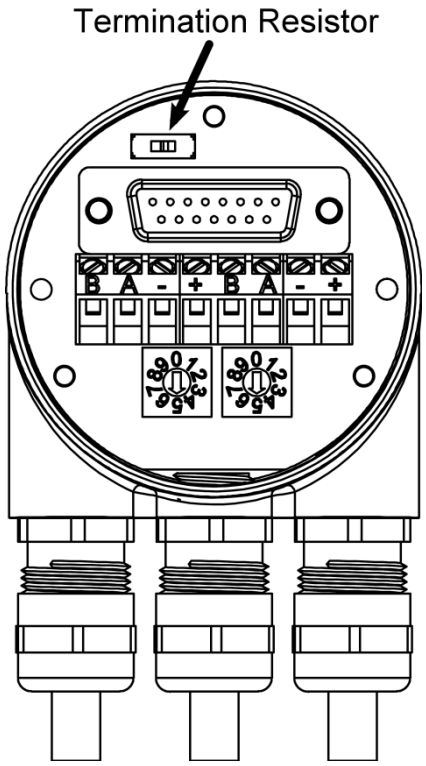
2 Installation

The Absolute Encoder is connected with a connection cap. This cap is connected to the encoder with a 15-pin-D-Sub connector and can be removed by loosening two screws on the backside of the encoder. Bus lines and power supply are led into the cap via cable glands and connected to terminal blocks.

2.1 Settings in the connection cap

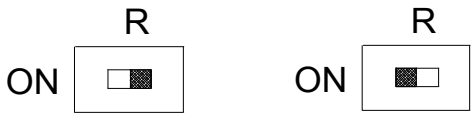
2.1.1 Station address

The station (node) address is set by using the rotary switches in the cap. The values (x 10 or x 1) for the switches are marked at the switch. Possible addresses are between 0 and 99. Each address can only be used once in the network. The station address is read in when switching on the power supply. An address change by the Master (“Set_Slave_Add“) is not supported.



2.1.2 Bus termination

If the encoder is connected at the end or beginning of the bus line the termination resistor must be switched on (slide switch in position “ON”).



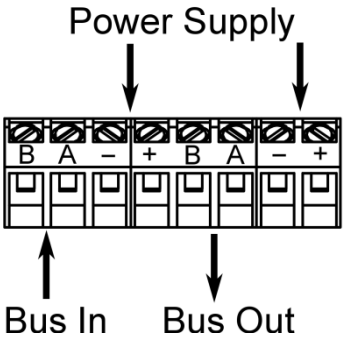
device X last device

Note

The outgoing bus line is disconnected if the resistor is switched on!

The bus is only correctly terminated when the encoder is connected to the connection cap. If the encoder must be changed during operation, a separate active bus termination should be used.

2.2 Connecting bus lines and power supply



Clamp	Description
B (left)	Bus line B (Bus in)
A (left)	Bus line A (Bus in)
–	0 V
+	10 – 30 V
B (right)	Bus line B (Bus out)
A (right)	Bus line A (Bus out)
–	0 V
+	10 – 30 V

The power supply has to be connected once (no matter which clamps). If the terminating resistor is switched on, the outgoing bus lines are disconnected.

2.3 Connecting-up the connection cap with cable glands

1. Cut off cable sheath and expose bralded screen over a length of appr. 10-15 mm depending on the cable diamter.
2. Push dome nut and lamellar insert with sealing ring on to the cable.
3. Bend braided screen outwards at a right angle (90°).
4. Fold braided screen towards outer sheath, i.e. by another 180°.
5. Push lamellar insert with sealing ring into gland body and snap anti-rotation element into place.
6. Screw on dome nut with 3,5 Nm.

Allowed cable diamter 5 – 9 mm for connection cap type AH58-B1CS-3PG and AH58-B1CS-3PG-VA.

Installation hints

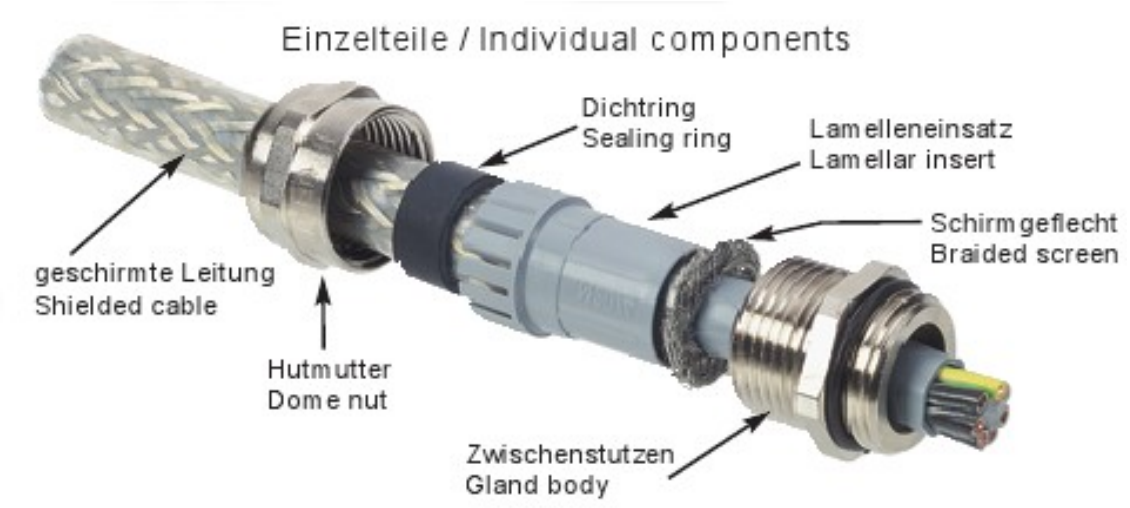
Both the cable shielding and the metal housings of encoders and subsequent electronics have a shielding function. The housing must have the same potential and be connected to the main signal ground over the machine chassis or by means of a separate potential compensating line. Potential compensating lines should have a minimum cross section of 6 mm^2.

Do not lay signal cable in the direct vicinity of interference sources (air clearance > 100 mm (4 in.).

A minimum spacing of 200 mm (8 in.) to inductors is usually required, for example in switch-mode power supplies.

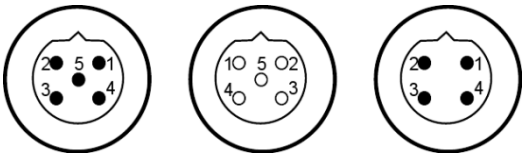
Configure the signal lines for minimum length and avoid the use of intermediate terminals. Shielded field bus cables shall be used! The shield must be grounded according to EMI rules!

In metal cable ducts, sufficient decoupling of signal lines from interference signal transmitting cable can usually be achieved with a grounded partition



2.4 Assignment for M12 connectors (AH58-B1DP-072)

Connecting the data lines and the power supply



Data lines and power supply are connected to

- 5 pin M12 connector
- 5 pin M12 female socket
- 4 pin M12 connector

5pin connector (left)

Pin	Description
1	not connected
2	Bus line A (Bus in)
3	not connected
4	Bus line B (Bus in)
5	not connected

5pin female socket (center)

Pin	Description
1	not connected
2	Bus line A (Bus out)
3	not connected
4	Bus line B (Bus out)
5	not connected

4pin connector (right)

Pin	Description
1	10 – 30 V DC
2	not connected
3	0 V
4	not connected

If the terminating resistor is switched on the outgoing bus lines are disconnected.

2.5 Connecting the screen

To achieve the highest possible noise immunity shielded cables should be used for data transmission. The shield should be connected to ground on both ends of the cable. In certain cases, a compensation current might flow over the shield. Therefore a potential compensation cable is recommended.

2.6 Instructions for mechanical installation and electrical connection of the angular encoder

The following points should be observed:

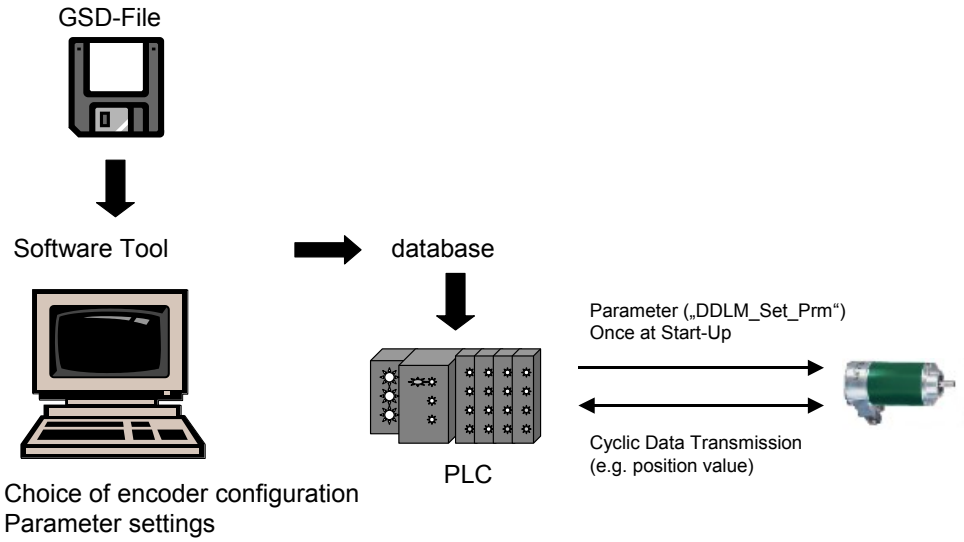
- Do not drop the angular encoder or subject it to excessive vibration. The encoder is a precision device.
- Do not open the angular encoder housing (this does not mean that you cannot remove the connection cap). If the device is opened and closed again, it can be damaged and dirt may enter the unit.
- The angular encoder shaft must be connected to the shaft to be measured through a suitable coupling (full shaft version). This coupling is used to dampen vibrations and imbalance on the encoder shaft and to avoid inadmissible high forces. Suitable couplings are available from FRABA.
- Although FRABA absolute encoders are rugged, when used in tough ambient conditions, they should be protected against damage using suitable protective measures. The encoder should not be used as handles or steps.
- Only qualified personnel may commission and operate these devices. These are personnel who are authorized to commission, ground and tag devices, systems and circuits according to the current state of safety technology.
- It is not permissible to make any electrical changes to the encoder.
- Route the connecting cable to the angular encoder at a considerable distance or completely separated from power cables with their associated noise. Completely shielded cables must be used for reliable data transfer and good grounding must be provided.
- Cabling, establishing and interrupting electrical connections may only be carried-out when the equipment is in a no-voltage condition. Short-circuits, voltage spikes etc. can result in erroneous functions and uncontrolled statuses which can even include severe personnel injury and material damage.
- Before powering-up the system, check all of the electrical connections. Connections, which are not correct, can cause the system to function incorrectly. Fault connections can result in severe personnel injury and material damage.

3 Device Configuration

The Absolute Encoder with Profibus-Interface can be programmed according to the needs of the user. The GSD-file has to be installed in the used software tool. The user has the possibility to choose different encoder configurations. Parameters and functionality depend on the selected encoder configuration. FRABA-Absolute Encoders Type „OCD-DPC1B-XXXX-XXXX-0CC“ support all configurations described in the following, i.e. there is no functionality limitation due to the hardware. Additionally to the configurations „Class 1“ and „Class 2” (according to the Profile for Encoders) the FRABA Encoder offers configurations with manufacturer-specific functions. By choosing a certain encoder configuration parameter and configuration data are determined. These data are stored in the Profibus master. They are transmitted to the slave (encoder) when the Profibus network is starting up („DDLM_Set_Prm“). It is not possible to change parameters or configuration during the normal operation of the device (exception: “Commissioning Mode”, see chapter 5.3).

After receiving configuration and parameter data the absolute encoder enters the normal operating mode (cyclic data transmission – „DDLM_Data_Exchange“). In this mode the process values (e.g. the position value) are transmitted. Data length and format are determined by the user when selecting a certain encoder configuration.

3.1 Overview – Configuration principle



3.2 Overview encoder configurations - functionality

Designation	Cyclic communication	Programmable parameters	Additional functions
Class 1 Singleturn	Position value - 16 bit Input	Code sequence	-
Class 1 Multiturn	Position value - 32 bit Input	Code sequence	-
Class 2 Singleturn	Position value - 16 bit Input Preset value - 16 bit Output	Code sequence Scaling factor	Preset function
Class 2 Multiturn	Position value - 32 bit Input Preset value - 32 bit Output	Code sequence Scaling factor	Preset function
FRABA 2.1 Singleturn	Position value (32 bit Input) Preset value / Teach-In (32 bit Output)	Code sequence Scaling factor Shorter Diagnostics Limit switches	Preset function Commissioning mode
FRABA 2.1 Multiturn	Position value (32 bit Input) Preset value / Teach-In (32 bit Output)	Code sequence Scaling factor Shorter Diagnostics Limit switches	Preset function Commissioning mode
FRABA 2.2 Singleturn	Position value (32 bit Input) Preset value / Teach-In (32 bit Output) Velocity (16 bit Input)	- Code sequence - Scaling factor - Shorter Diagnostics - Limit switches - Velocity time base	Preset function Commissioning mode Velocity Output
FRABA 2.2 Multiturn	Position value (32 bit Input) Preset value / Teach-In (32 bit Output) Velocity (16 bit Input)	- Code sequence - Scaling factor - Shorter Diagnostics - Limit switches - Velocity time base	Preset function Commissioning mode Velocity Output

3.3 Encoder configurations - data format

Designation	Configuration		Input words (Encoder -> Master)	Output words (Master -> Encoder)	Description	
	Hex	Dec.			Chapter	Page
Class 1 Singleturn (According to Profile)	D0	208	1	0	4	13
Class 1 Multiturn (According to Profile)	D1	209	2	0		
Class 2 Singleturn (According to Profile)	F0	240	1	1		
Class 2 Multiturn (According to Profile)	F1	241	2	2		
FRABA 2.1 Singleturn	F1	241	2	2	5	18
FRABA 2.1 Multiturn	F1	241	2	2		
FRABA 2.2 Singleturn	F1	241	2	2		
	D0	208	1			
FRABA 2.2 Multiturn	F1	241	2	2		
	D0	208	1			

The following encoder configurations are still supported for reasons of downward compatibility, but should not be used for new projects (description: see Appendix):

Class 2 Multiturn „DX-Version“	F1	241	2	2	10.2.4	44
FRABA 1.0 Multiturn	D3	211	4	0	10.2.3	44
FRABA 1.1 Multiturn	D3	211	4	0	10.2.2	44
	E1	225	0	2		
FRABA 2.0 Multiturn	F1	241	2	2	10.2.1	44
	D0	208	1			

4 Class 1 and Class 2 profile

The encoder versions Class 1 and Class 2 are defined by the working group encoder in the „Profibus Nutzerorganisation“ in the “Profile for Encoders” (available from the PNO, Order No. 3.062).

4.1 Parameter settings

The following table contains an overview of the parameters according to the Profile for Encoders and the structure of the parameter telegram. (Usually it is not necessary for the user to know the details of the structure – the parameters are set in user-friendly forms in the operator software tool.)

Octet (= byte) No.	Parameter	Bit Nr.	Details
1 ... 8	Profibus Standard Parameters		
9	Code sequence	0	
	Class 2 functionality	1	Section 4.1.2, Page 14
	Commissioning Diagnostics	2	Section 4.1.3, Page 14
	Scaling function	3	Section 4.1.4, Page 14
	Reserved	4	
	Reserved	5	
	Not used for Class 1 and Class 2	6	
		7	
10 ... 13	Measuring units per revolution		Section 4.1.5, Page 14
14 ... 17	Total measuring range		Section 4.1.6, Page 15
18 ... 25	Reserved (Profile)		
26 ...	Not used for Class 1 and Class 2 (Refer to versions FRABA 2.1 und 2.2)		

4.1.1 Code sequence

The parameter „code sequence“ defines the counting direction of the position value. The code increases when the shaft is rotating clockwise (CW) or counter-clockwise (CCW) (view onto the shaft). The code sequence is defined in bit 0 of octet 9:

Octet 9 Bit 0	Direction of rotation when viewing the shaft	Code
0	Clockwise (CW)	Increasing
1	Counter-clockwise (CCW)	Increasing

In Class 1 this is the only parameter that can be set.

4.1.2 Class 2 functionality

Using this switch Class 2 encoders can be restricted to the functionality of Class 1, i.e. the scaling parameters are disabled. To use the class 2 functionalities bit 1 in octet 9 has to be set.

Octet 9 Bit 1	Class 2 functionality
0	Switched off
1	Switched on

4.1.3 Commissioning diagnostics

This function has no significance for the FRABA encoder.

4.1.4 Scaling function

The parameter „scaling function“ enables the scaling parameters „resolution per revolution“ and „total resolution“. This switch should always be activated if functions of class 2 (or even higher classes FRABA 2.1 and FRABA 2.2) are to be used.

Octet 9 Bit 3	Scaling function
0	Switched off
1	Switched on

4.1.5 Measuring units per revolution

The parameter „measuring units per revolution“ is used to program a desired number of steps over one revolution. If the value exceeds the basic (physical) resolution of the encoder, the output code is no longer in single steps. Starting with generation “B1” the encoder indicates a parameter error (LED) and it will not enter the data exchange mode.
With high resolution encoders it may be necessary to divide the value into high and low word (depending on the software tool), refer to page 36.

Octet	10	11	12	13
Bit	31 - 24	23 - 16	15 - 8	7 – 0
Data	2^{31} to 2^{24}	2^{23} to 2^{16}	2^{15} to 2^{8}	2^{7} to 2^{0}
	Desired measuring units per revolution			

4.1.6 Total measuring range

Octet	14	15	16	17
Bit	31 – 24	23 – 16	15 - 8	7 - 0
Data	2^{31} to 2^{24}	2^{23} to 2^{16}	2^{15} to 2^{8}	2^{7} to 2^{0}
	Programmed total measuring range in steps			

The parameter „total measuring range“ is used to adapt the measuring range of the encoder to the real measuring range of the application. The encoder counts up until the position value has reached the programmed total resolution and starts with 0 again.
Example: 100 steps are programmed for each revolution (parameter „measuring units per revolution“) and the total resolution is set to 12800. Then the encoder counts up to 11799, starts with “0” again after 128 revolutions, counts up to 11799, and so on.
Note: With many software tools it is necessary to divide the value into high and low word, refer to page 36.
When choosing the total resolution the following rule has to be observed:

If “steps per revolution” are set to “n” the parameter total resolution must not cause periods longer than the maximum (physical) number of revolutions (see type label), i.e. that the programmed total resolution of a 4096 revolution multiturn encoder must be less than 4096 x the programmed number of steps per revolution (the programmed total resolution of a 16384 revolution multiturn encoder must be less than 16384 x the programmed number of steps per revolution):

Total resolution < measuring units per revolution x real number of revolutions (physical)

If this rule is disregarded the encoder will indicate a parameter error and it will not enter the data exchange mode.

With older versions a further rule had to be observed (see below). If this rule was ignored, problems occurred when using the device in endless operation (when crossing the physical zero point). With new devices (software version 3 Generation A1 or higher) this problem is solved by an internal software routine. For that reason the 2nd rule can be ignored if a new device is used.

The period, i.e. “Total resolution” / “measuring units” per revolution must be an integer number of times (integer multiple) into 4096. So the following equation must apply:

(4096 x measuring units per revolution) / Total resolution = integer

For devices with 16384 revolutions the following equation must apply:

(16384 x measuring units per revolution) / Total resolution = integer

Note: The internal software routine only works if the encoder is in operation. If it is necessary to turn the encoder shaft more than 4096 revolutions without power supply this can lead to problems (the internal routine will not work without power supply). In this case the following rule should be observed even with new devices:

The period, i.e. “Total resolution” / “measuring units” per revolution must be an integer and it must fit an integer number of times (integer multiple) into 16384. So the following equation must apply:

(16384 x measuring units per revolution) / Total resolution = integer

4.2 Data exchange in normal operation

The „DDLM_Data_Exchange mode“ is the normal operation mode of the device. On request the encoder transfers the current (position) value to the master. The encoder can also receive data from the master (e.g. the preset value in the class 2 configuration).

4.2.1 Transferring the process value

The multiturn encoder transmits the current position value as a 32-bit-value (double word) to the master.

Word	Word 1																Word 0															
Function	Process value																															
Bit	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
	0	0	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

The Singleturn encoder uses a 16-bit-value (word) for data transmission.

4.2.2 Preset function

Using the preset function it is possible to adapt he encoder zero point to the zero point of the application. When using this function the current encoder position value is set to the desired preset value. The integrated microcontroller calculates the internal zero point shift. It is stored non-volatile in an EEPROM (takes less than 40 ms).
The preset value is activated if bit 31 in the (peripheral) output double word is set to 1 (rising edge). As the preset function is used after receiving the scaling parameters the preset value refers to the scaled position value.

			Data bits																											
	Bit	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Master → OCD		**1**	0	Transfer of the required position value (= preset value)																												
OCD → Master		0	0	New = required position value is transferred																												
Master → OCD		0	0	Reset bit 31 – normal mode																												
OCD → Master		0	0	New = required position value is transferred																												

If high precision is required the preset function should only be executed if the encoder shaft is not moving. If the shaft moves quickly during the preset procedure, this can result in offsets (because of bus delay times).

Note for Singleturn devices

The procedure is similar with the singleturn-version: Here Bit 15 is used to activate the preset value. With high resolution singleturn encoders (16 Bit) it is not possible to set preset values > 32767 (15 bit), as the MSB is used to activate the preset. If this functionality is needed the user has to choose one of the manufacturer specific FRABA-encoder versions (in these classes the singleturn position is transmitted as 32-bit-value).

5 Special versions FRABA 2.1 and 2.2

The manufacturer-specific encoder configurations FRABA 2.1 and FRABA 2.2 offer (in addition to the functions according to the Profile for Encoders) features such as commissioning mode, velocity output and software limit switches.

The following table gives an overview of the used parameters and the structure of the parameter telegram.
Usually it is not necessary to know these details as the parameters are set with user-friendly software tools.

Octet (byte) No.	Parameter	Bit No.	Details Section	Page
1 .. 8	Profibus Standard Parameters			
9	Code sequence	0	4.1.1	14
	Class 2 functionality	1	4.1.2	14
	Commissioning Diagnostics	2	4.1.3	14
	Scaling function	3	4.1.4	14
	Reserved	4		
	Reserved	5		
	Activate manufacturer-specific parameters (octet 26)	6	5.1.1	19
	Reserved	7		
10 .. 13	Desired measuring units (refer to: octet 26 bit 0 and 1)		5.1.2	19
14 .. 17	Total measuring range		4.1.6	15
18 .. 25	Reserved			
26	Reference for the desired measuring steps	0	5.1.3	20
		1		
	Activate commissioning mode	2	5.1.4	21
	Shorter Diagnostics	3	5.1.5	21
	Reserved	4		
	Activate lower limit-switch	5	5.1.6	21
	Activate upper limit-switch	6	5.1.6	21
	Activate octets 27-39	7	5.1.1	19
27 .. 30	Lower limit switch		5.1.6	21
31 .. 34	Upper limit switch		5.1.6	21
35 .. 38	Physical impulses		5.1.7	22
39	Reserved	0		
	Encoder type (Single-/Multiturn)	1	5.1.8	23
	Reserved	2		
	Reserved	3		
	Time base velocity	4	5.1.9	23
		5		
	Reserved	6		
	Reserved	7		

5.1 Parameter

In the following the manufacturer specific parameters are described in detail. The parameters according to the Profile for Encoders are supported too, description: see chapter 4.

5.1.1 Activate manufacturer-specific parameters

The manufacturer-specific parameter byte 26 is activated with bit 6 in octet 9.
Bit 7 in octet 26 activates further parameter bytes (27-39).
Usually this happens automatically if the encoder versions FRABA 2.1 or FRABA 2.2 are selected. It is only important for the user to observe this if the parameters are entered “manually” (directly using hex-code).

Octet 9 Bit 6	**Octet 26**
0	Deactivated
1	Activated

Octet 26 Bit 7	**Octet 27 – 39**
0	Deactivated
1	Activated

5.1.2 Desired measuring units

The parameter „desired measuring units“ is used to program any required number of steps over 1 revolution, over the whole measuring range or over a part of the measuring range.

Octet	10	11	12	13
Bit	31 - 24	23 - 16	15 - 8	7 – 0
Data	2^{31} to 2^{24}	2^{23} to 2^{16}	2^{15} to 2^{8}	2^{7} to 2^{0}
	Desired measuring units			

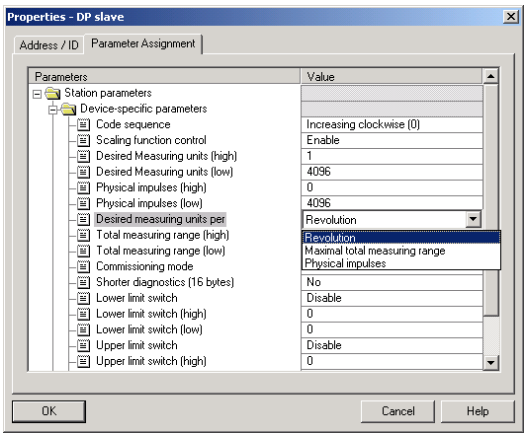
The reference for the desired measuring units is specified with the parameter „Desired measuring units reference“ (cp. 5.1.3). If “per revolution” is selected the measuring range can be adapted with the parameter “total measuring range”. Please observe the rules in section 4.1.6.

Note: With many software tools it is necessary to divide the value into high and low word, refer to page 36.

5.1.3 Desired Measuring units reference

With this parameter the reference for the desired measuring units (cp. 5.1.2) is determined, either

- per revolution
- per maximum total resolution
- per number of physical impulses



Desired measuring units per **revolution**
In this case the position value increases by the programmed number of steps (desired measuring units) over one revolution.
Additionally the parameter “total resolution” is used to achieve an adaptation of the measuring range (cp. 4.1.6).

Desired measuring units per **maximum total measuring range**
The parameter „desired measuring units“ refers to the complete measuring range of the encoder, i.e. the encoder gives out the programmed number of measuring units over the whole measuring range (4096 revolutions with the multi turn encoder).

Desired measuring units per **physical impulses**
The desired measuring units refer to the physical impulses entered in octets 35-39 (cp.5.1.7). Physical impulses means: The real value that is read internally from the code disc (e.g. 4096 steps per revolution with a standard 12-bit-encoder).
With that option it is possible to set gearing factors freely.

Reference	**Octet 26 Bit 0**	**Octet 26 Bit 1**
Per revolution	0	0
Per maximum total measuring range	1	0
Per physical impulses (= steps specified in octets 35-38)	0	1

5.1.4 Activate commissioning mode

Bit 2 in octet 26 activates the commissioning mode. This is a special mode with the option to set further parameters in the data-exchange –mode (additional to the preset value). In the commissioning mode a „Teach-In“ can be carried out, i.e. the gearing factor can be determined directly in the machine. In this special mode (indicated by the flashing green LED) the parameters set in the system configuration are ignored by the encoder. It uses parameters stored in an internal EEPROM instead.

The commissioning mode can be used durably, but it is recommended to transfer the parameters determined with the Teach-In into the system configuration. Then the encoder should be used in “normal” operation mode – so it is possible to exchange the device without a new Teach-In.
A detailed description of the commissioning mode can be found in section 5.3.

Octet 26 Bit 2	Commissioning mode
0	Switched off
1	Switched on

5.1.5 Shorter Diagnostics

Some Profibus masters, especially older ones, have problems with the full diagnostic data length (57 bytes). The FRABA encoder offers the option to reduce the diagnostic data length to 16 bytes. If Class 1 is used the standard diagnostic data length is 16 bytes.

Octet 26 Bit 3	Diagnostics
0	Standard = 57 bytes
1	Reduced = 16 bytes

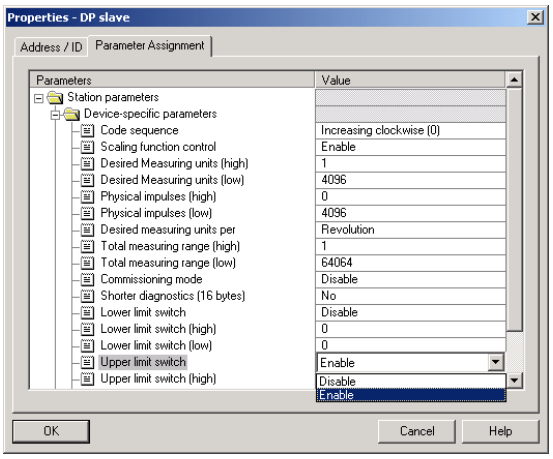
5.1.6 Software-limit switch

Two positions can be programmed. If the position value falls below the lower limit switch or exceeds the higher limit switch, bit 27 in the 32-Bit-process-value is set to 1. Between these limit switches bit 27 is set to 0. The limit switches can be set to any value, but the parameter “total measuring range” must not be exceeded. The limit switches are activated with bits 5 and 6 in octet 26.
Note: With many software tools it is necessary to divide the values into high and low word, refer to page 36.

Octet	27	28	29	30
Bit	31 - 24	23 - 16	15 – 8	7 - 0
Data	2^{31} to 2^{24}	2^{23} to 2^{16}	2^{15} to 2^{8}	2^{7} to 2^{0}
	Lower limit switch (in measuring steps, related to the scaled value)			

Octet	31	32	33	34
Bit	31 - 24	23 - 16	15 – 8	7 - 0
Data	2^{31} to 2^{24}	2^{23} to 2^{16}	2^{15} to 2^{8}	2^{7} to 2^{0}

	Upper limit switch (in measuring steps, related to the scaled value)



Octet 26 Bit 5	Lower limit switch
0	Deactivated
1	Activated

Octet 26 Bit 6	Upper limit switch
0	Deactivated
1	Activated

5.1.7 Physical impulses

Octet	35	36	37	38
Bit	31 - 24	23 – 16	15 – 8	7 - 0
Data	2^{31} to 2^{24}	2^{23} to 2^{16}	2^{15} to 2^{8}	2^{7} to 2^{0}
	Physical impulses			

This parameter is evaluated if the reference for the „desired measuring units“ is „physical impulses“ (cp. 5.1.3).
With the „physical impulses“ it is possible to set a gearing factor freely. The user defines the output steps („desired measuring steps”) over a part of the measuring range. This option is helpful to program scaling factors that result in a non-integer number of steps over 1 revolution.

Example:
Problem: The position value has to increase by 400 steps over 3 revolutions.

With the reference „steps per revolution“ it is impossible to program that scaling factor (it would be necessary to set the parameter „desired measuring steps“ to 133.33; this is not possible because the parameter must be an integer value).

Solution:
Choose „physical impulses“ as reference for the „desired measuring units“.
Now the number of physical measuring steps over the desired measuring range is determined. For this the actual (physical) resolution of the encoder (type label) is used. For our example this would be (with a standard encoder, 12 Bit resolution):
4096 steps/revolution x 3 revolutions = 12288 steps
Enter this value (12288) as „physical impulses“ and set the „desired measuring units“ to 400. Now the

encoder increases the position value by 400 steps on a measuring range of 12288 physical steps (3 revolutions).

Note: With many software tools it is necessary to divide the value into high and low word, refer to page 36.

5.1.8 Encoder type

The encoder type (Singleturn or Multiturn) is specified in bit 1 octet 39. Generally this bit is set automatically if the encoder version is selected. The user only has to take care of this parameter if the parameters are set “manually” in hex-code.

Octet 39 Bit 1	Type
0	Singleturn
1	Multiturn

5.1.9 Velocity time base

With this parameter the user can choose the time base for the velocity output (version FRABA 2.2). The time base is specified in bits 4 and 5 of octet 39.

Time base	Bit 4	Bit 5
Steps / second	0	0
Steps / 100 ms	1	0
Steps / 10 ms	0	1
RPM (revolutions per minute)	1	1

5.2 Data exchange in normal operation

With the manufacturer-specific versions FRABA 2.1 and FRABA 2.2 the process value generally is transmitted as 32-bit-value (peripheral double word). Apart from 25 bits used for the position value the 7 other bits are used as status bits. The output double word contains the preset value and control bits.

Absolute encoders model series “OCD” might have (physical) position values > 25 Bit. The manufacturer specific FRABA versions do not support the position values > 25 Bit. The upper digits will be overwritten by the status bits. If the FRABA versions are used with encoders with a total (physical) resolution > 25 Bit, the user has to assure that the position value is scaled to a maximum output value < 33554432. If position values > 25 Bit are necessary class 2 should be used.

If version FRABA 2.2 is used the current velocity is transmitted in an additional (peripheral) input word.

ID	F1 hex				D0 hex	
OCD → Master	Status + position value				Velocity	
	Status + 2^{24}	2^{23} - 2^{16}	2^{15} - 2^{8}	2^{7} - 2^{0}	2^{15} - 2^{8}	2^{7} - 2^{0}

Master → OCD	Preset value + control bits			
	Control + 2^{24}	2^{23} - 2^{16}	2^{15} - 2^{8}	2^{7} - 2^{0}

Meaning of the different status bits:

Bit 28	Bit 27	Bit 26	Bit 25	Meaning
				Ready
				0 = encoder is not ready for operation
				1 = encoder is ready for operation
				Mode
				0 = commissioning mode
				1 = normal mode
				Software limit switch
				0 = lower limit switch ≤ current position value ≤ upper limit switch
				1 = current position value > upper limit switch or current position value < lower limit switch
				Code sequence
				0 = increasing clockwise (view onto the shaft)
				1 = increasing counter clockwise (view onto the shaft)

5.3 Commissioning mode

If the commissioning mode is activated in the encoder parameters, the scaling factor can be determined directly in the machine by a „Teach-In“. The commissioning mode is indicated by the flashing green LED and bit 26 in the input double word (bit 26 set to 0).

If the encoder starts up in commissioning mode the parameters in the system configuration (code sequence, scaling) are ignored. Parameters stored in an internal EEPROM are used instead. If code sequence or scaling factor are modified in commissioning mode, the new values will be stored non-volatile and the encoder works with this new parameters.

The proceeding in commissioning mode is as follows:

- The encoder is installed in the machine / system.
- The commissioning mode is activated (parameter settings, cp. 5.1.4)
- The counting direction is changed (if necessary).
- Machine / system is to be moved to the start position.
- The Teach-In-Start command is transmitted to the encoder.
- Machine / system is to be moved to the stop position.
- With the Teach-In-Stop command the desired number of steps is transferred to the encoder.
- Set the preset value.
- The parameters in the system configuration are set to the values determined with the Teach-In procedure.
- Commissioning mode is deactivated (parameter settings).

5.3.1 Setting the counting direction

If the encoder is operating in commissioning mode, the counting direction (code sequence) can be changed online. The current code sequence is indicated with bit 28 in the 32-bit-process value (0: increasing clockwise / 1: increasing counter clockwise). With bit 28 in the output double word the counting direction can be changed.

	Status bits							Data bits																								
Bit	31	30	29	**28**	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Master → OCD	0	0	0	**1**	0	0	0	Changing the counting direction by setting bit 28																								
OCD → Master	0	0	0	**0/1**	0	0	1	Encoder sends acknowledgement (new counting direction) in bits 0 and 28																								**0/1**
Master → OCD	0	0	0	**0**	0	0	0	Changeover is completed by reset bit 28																								
OCD → Master	0	0	0	**0/1**	X	0	1	Output process value with changed counting direction																								

The counting direction is stored non-volatile in an internal EEPROM.

5.3.2 Teach-In Start

After the machine / system has been moved to the start-position the Teach-In-Start command is transmitted to the encoder. The device now starts the internal calculation of a new scaling factor.

	Status bits							Data bits																					
Bit	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Master → OCD	0	**1**	0	0	0	0	0	Start the Teach-In by setting bit 30 to 1																								
OCD → Master	0	**1**	0	X	X	0	1	Acknowledgement of the encoder by setting bit 30 to 1																								
Master → OCD	0	**0**	0	0	0	0	0	Reset bit 30																								
OCD → Master	0	**1**	0	X	X	0	1	Non-calculated position value is transmitted (gearing factor = 1, no offset)																								

Note: The scaling factor is set to 1; the zero point shift is set to zero.

5.3.3 Teach-In Stop

After moving the machine / system to the stop-position the Teach-In-Stop command is send. Together with this command the desired number of steps over the moved measuring range is transmitted. The user has to observe that the physical resolution is not exceeded (e.g. 20000 steps on a quarter of a revolution). Positive and negative directions are taken into account automatically, also the crossing of the physical zero point. Note: The measuring range must not exceed the half physical measuring range of the encoder (i.e. a maximum of 2047 revolutions for a multiturn device with 4096 revolutions and a maximum of 8181 revolutions for the 14-Bit-multiturn).

After receiving the Teach-In-Stop command the encoder transmits the calculated total resolution. This value should be noted and later (when switching the device to normal mode) entered into the parameter settings.

After this Teach-In procedure the encoder operates with the new gearing factor (which is stored non-volatile in the internal EEPROM).

	Status bits							Data bits																					
Bit	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Master → OCD	0	0	**1**	0	0	0	0	**Number of desired measuring steps** (on the traversed measuring range)																								
OCD → Master	0	1	**1**	X	X	0	1	**Transfer of the total resolution** (should be noted)																								
Master → OCD	0	0	**0**	0	0	0	0	Reset bit 29																								
OCD → Master	0	0	**0**	X	X	0	1	Output of the current position value, scaled with the new gearing factor																								

In order to replace the encoder later without a new Teach-In procedure, the total measuring range determined with the Teach-In should be transferred into the system configuration. For this the „total resolution“ must be entered into the parameter field „desired measuring units“ (cp. 5.1.2) and the reference (cp. 5.1.3) must be set to “maximum total measuring range“. When setting the parameters it should be observed that the code sequence is correct (the setting of the counting direction in commissioning mode has to be transferred to the system configuration). Subsequently the commissioning mode can be

switched off and the encoder can be used in normal mode.

5.3.4 Preset value

The preset function is similar to the procedure described in section 4.2.2. There is only one difference: When using the manufacturer-specific versions FRABA 2.1 or FRABA 2.2 there is an acknowledgement (bit 31 in the input double word is set to 1):

	Status bits							Data bits																							
Bit	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Master → OCD	**1**	0	0	0	0	0	0	Transfer of the required position value (= preset value)																								
OCD → Master	**1**	0	0	0	0	0	1	New = required position value is transferred																								
Master → OCD	0	0	0	0	0	0	0	Reset bit 31 – normal mode																								
OCD → Master	0	0	0	0	0	0	1	New = required position value is transferred																								

6 Diagnostic messages

6.1 Overview

On request of the master the encoder transmits diagnostic data ("DDLM_Slave_Diag"). The diagnostic data length is 57 bytes (Exception: shorter diagnostics, cp. 5.1.5). The format of the diagnostic data is according to the Profibus Standard (octets 1-6) respectively according to the Profile for Encoders (starting from octet 7).

Diagnostic function	Data type	Diagnostics - octet number	Class
Station status 1 (ref. to: Profibus Standard)	Octet	1	1
Station status 2 (ref. to: Profibus Standard)	Octet	2	1
Station status 3 (ref. to: Profibus Standard)	Octet	3	1
Diagnostic master address	Octet	4	1
PNO identification number	Octet	5, 6	1
Extended diagnostic header	Octet String	7	1
Alarm messages	Octet String	8	1
Operating status	Octet String	9	1
Encoder type	Octet String	10	1
Resolution per revolution (Hardware)	Unsigned 32	11 - 14	1
Number of revolutions (Hardware)	Unsigned 16	15, 16	1
Additional alarm messages	Octet String	17	2
Supported alarm messages	Octet String	18, 19	2
Warnings	Octet String	20, 21	2
Supported warnings	Octet String	22, 23	2
Profile version	Octet String	24, 25	2
Software version	Octet String	26, 27	2
Operating time	Unsigned 32	28 - 31	2
Zero offset	Unsigned 32	32 - 35	2
Manufacturer-specific: offset value	Unsigned 32	36 - 39	2
Programmed resolution per revolution	Unsigned 32	40 - 43	2
Programmed total resolution	Unsigned 32	44 - 47	2
Serial number	ASCII String	48 - 57	2

6.2 Supported diagnostic messages

In the following the different diagnostic messages are described in detail.

6.2.1 Extended diagnostics header

Byte 7 contains the length of the extended diagnostics (including header itself).

6.2.2 Memory error

Bit 4 in diagnostic byte 8 is used to indicate a memory error.
Memory error means that the internal EEPROM of the encoder no longer works correctly and that it cannot be guaranteed that values (e.g. offset value) are stored non-volatile.

Bit	Definition	0	1
4	Memory error (defective EEPROM)	No	Yes

6.2.3 Operating status

Diagnostic byte 9 contains certain parameters (set in the system configuration).

Bit	Definition	0	1
0	Direction of rotation	CW	CCW
1	Class 2 functionality	Off	On
2	Diagnostic routine	Off	On
3	Scaling function	Off	On

6.2.4 Encoder type

Diagnostic byte 10 contains the encoder version (singleturn or multiturn).

Byte 10	Definition
0	Singleturn encoder
1	Multiturn encoder

6.2.5 Singleturn resolution

Diagnostic bytes 11-14 contain the real (physical) resolution per revolution of the encoder.

6.2.6 Number of revolutions

Diagnostic bytes 15 and 16 contain the real (physical) number of revolutions of the encoder. Standard values are 1 for singeturn and 4096 (resp. 16384) for multiturn devices.

6.2.7 Operating time warning

Bit 4 in diagnostic byte 21 indicates an operating time warning. The bit is set after 10^5 hours.

6.2.8 Profile version

Diagnostic bytes 24 and 25 contain the profile version of the encoder.

Byte	24	25
Bit	15 – 8	7 – 0
Data	2^7 - 2^0	2^7 - 2^0
	Revision No.	Index

6.2.9 Software version

Diagnostic bytes 26 and 27 contain the software version of the encoder.

Octet	26	27
Bit	15 – 8	7 - 0
Data	2^7 to 2^0	2^7 to 2^0
	Revision No.	Index

6.2.10 Operating time

The operating time of the encoder can be read out from diagnostic bytes 28 to 31. If the encoder is connected to the power supply the operating time is stored in an EEPROM every six minutes in 0.1 h steps.

6.2.11 Zero offset

The zero offset is output in diagnostic bytes 32 to 35.

6.2.12 Programmed resolution

The programmed resolution per revolution is output in diagnostic bytes 40 to 43. The value is only valid if the scaling factor is based on the parameter „resolution per revolution“ (cp. 5.1.3).

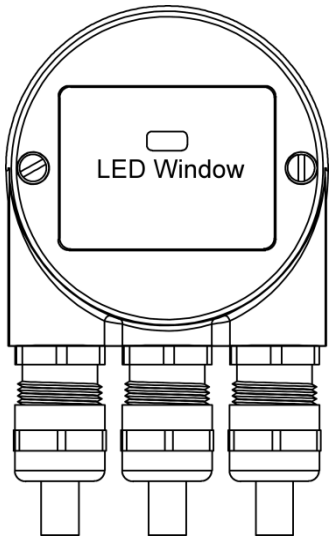
6.2.13 Programmed total resolution

The programmed, respectively calculated total resolution is output in diagnostic bytes 44-47.

6.2.14 Serial number

Diagnostic bytes 48-57 are intended for a serial number.
With the current version the serial number is not saved in the encoder, the bytes contain the default value 2A hex.

6.3 Status indication by the LEDs in the connection cap



Two LEDs are implemented in the connection cap. They optically indicate the status of the encoder in the Profibus network.
The red LED is used to display errors, the green one displays the status of the encoder. Both LEDs can have one of three possible conditions: dark, bright and flashing. Seven of the nine possible combinations are used to indicate a special condition.

If there are any problems with starting-up the system, the state of the LEDs can give important information about the error cause.

No.	Red LED	Green LED	Status / possible cause
1	Dark	Dark	No power supply.
2	Bright	Bright	Encoder is ready for operation but it has not received any configuration data after power on. Possible causes: address setting incorrect, Bus lines not connected correctly.
3	Bright	Flashing	Parameter or configuration error. The encoder receives configuration or parameter data with incorrect length or inconsistent data. Possible cause: parameter value “total measuring range” too high
4	Flashing	Bright	The encoder is ready for operation but not addressed by the master (e.g. incorrect address in configuration).
5	Bright	Dark	Encoder has not received any data for a longer period (about 40 sec.). Possible cause: bus line has been interrupted.
6	Dark	Bright	Normal operation in data exchange mode
7	Dark	Flashing	Commissioning mode

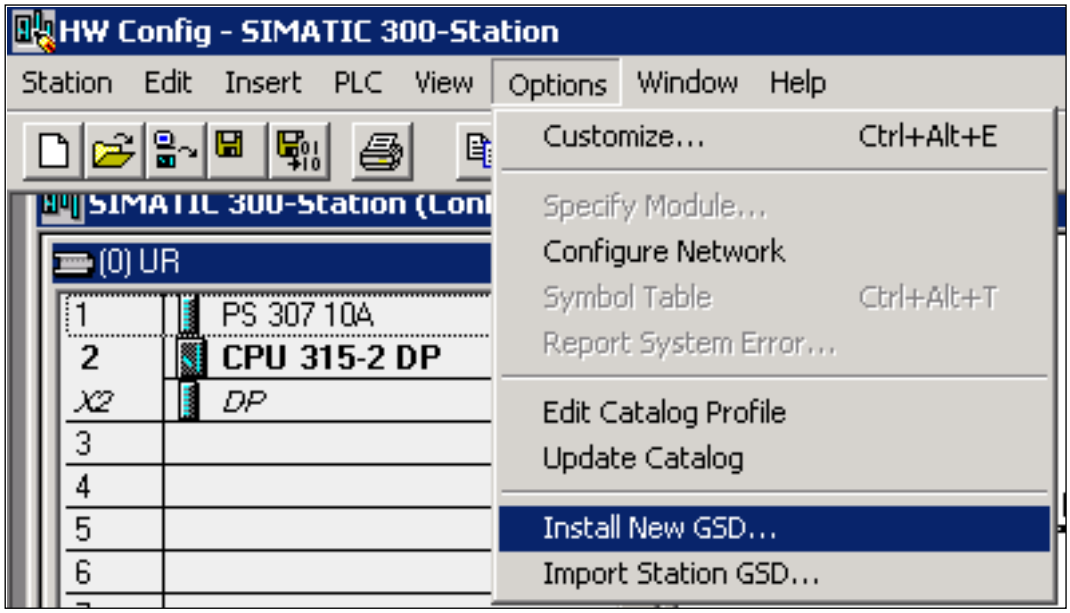
7 Configuring with STEP 7

In the following the configuration of the FRABA encoder with the configuration tool STEP 7 is shown exemplarily. In this example STEP 7 Version 5.1 and the CPU 315-2DP (Profibus-master integrated) are used. If there are questions about other software tools please contact the manufacturer.

7.1 Installing the GSD file

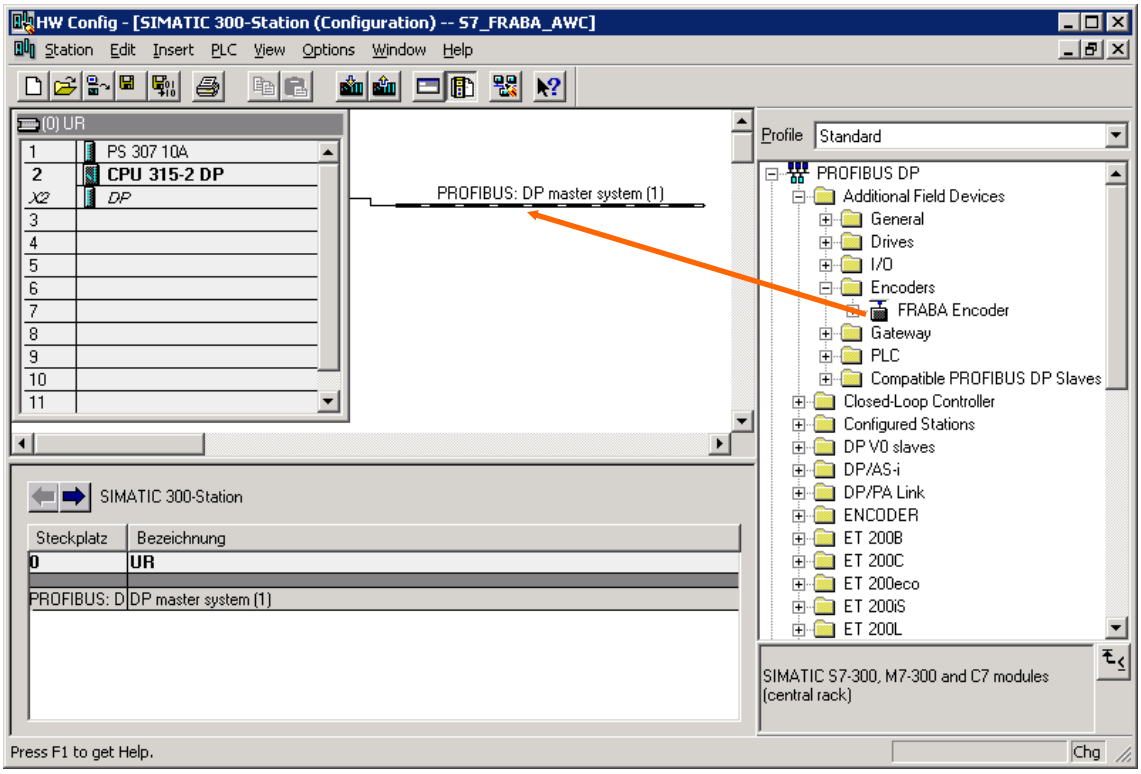
If FRABA encoders are used for the first time it is necessary to install the GSD file („FRAB4711.gsd“) to take over the encoder into the hardware catalogue of the tool:

Choose “Install New GSD” in the “HW Config”-window of the project (menu item “Options”) and select the GSD-file (“FRAB4711.gsd”).
The GSD file can be downloaded from our homepage www.posital.com.



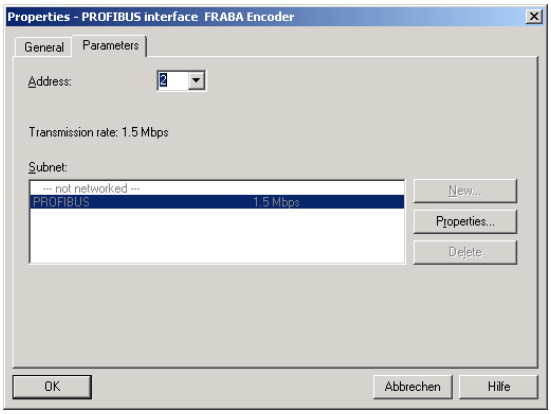
After the successful installation of the GSD file the FRABA encoder can be found in the hardware catalogue under „PROFIBUS-DP“ – „Additional Field Devices“ – „Encoders“ – „FRABA Encoder“.
In order to represent the encoder with a bitmap in STEP7 the bitmap file „OCDDPxxn.bmp“ has to be installed. The procedure is the same as with the GSD file.

7.2 Configuring the encoder



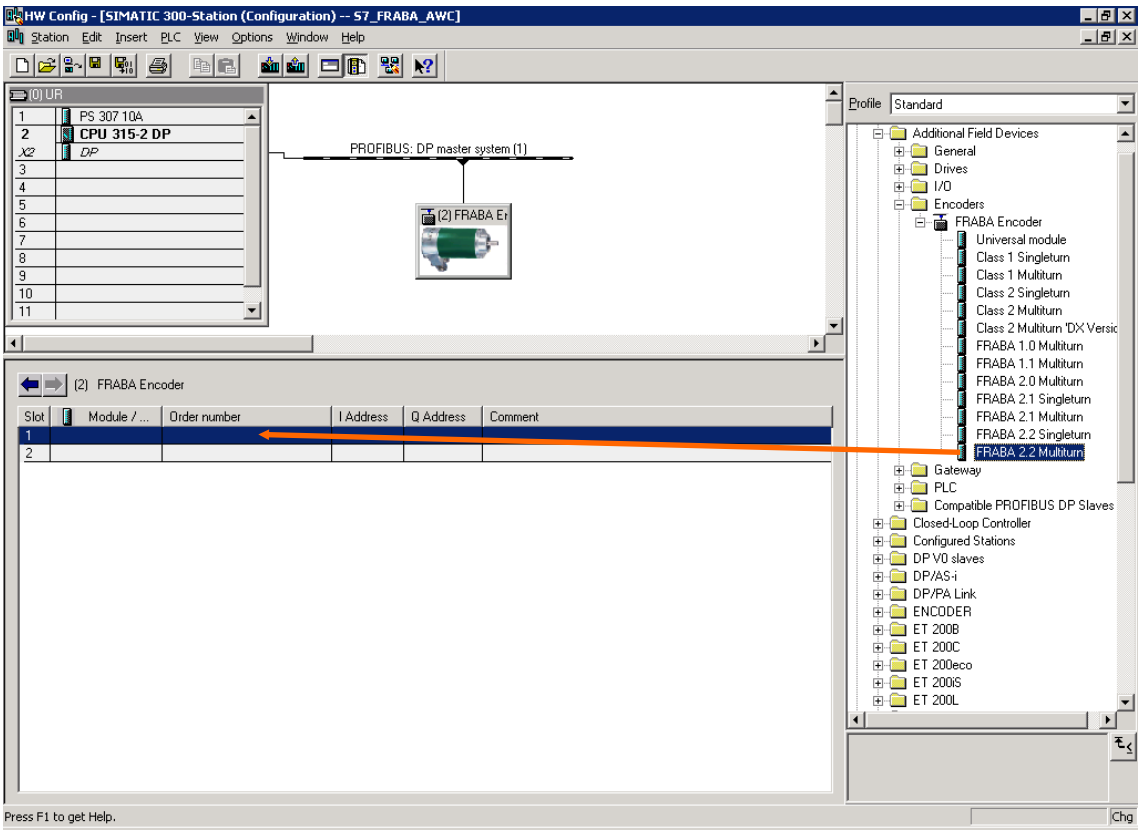
After inserting the Profibus master system in the hardware configuration (“Insert” – “Master System”) the FRABA encoder can be chosen from the hardware catalogue and added to the Profibus network: Select the device “FRABA Encoder” and drag it with the mouse to the network (or choose the network and double click the “FRABA encoder”).

Now the slave address has to be entered (has to be equal to the address setting in the connection cap).



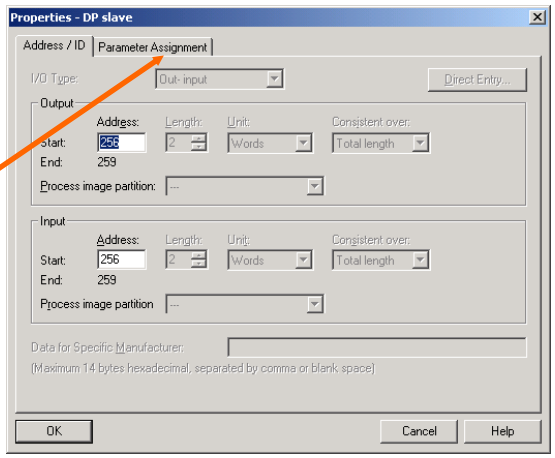
7.3 Selecting the encoder version

As described in chapter 3 the functionality of the encoder depends on the selected encoder version. After the “FRABA encoder” has been added to the network the desired encoder version can be selected. For this, one of the modules listed under FRABA encoder has to be dragged to Slot 1 in the displayed configuration table of the encoder.

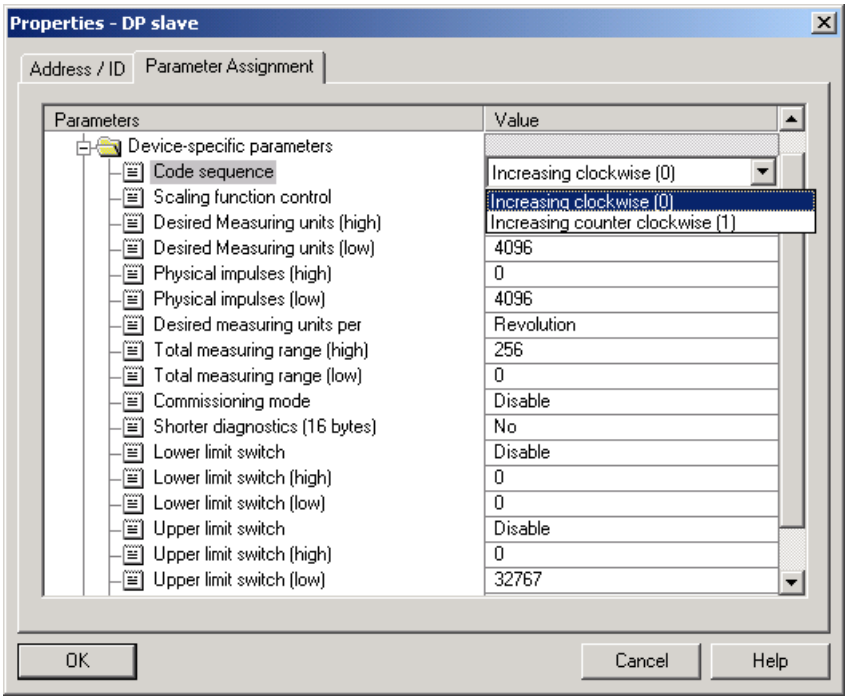


7.4 Setting the parameters

Select the encoder in the hardware configuration and double click slot one in the configuration table of the encoder. The dialog „Properties – DP slave“ appears. The input and output addresses can be changed (if desired). To set the encoder parameters the tab “Parameter Assignment” has to be selected.



After choosing the „Device-specific parameters“ the different parameters (depend on the encoder version) can be set.
If several possibilities are offered for one parameter the parameters list is opened by double clicking on it. Numerical values have to be entered directly. The example shows the parameters of encoder version FRABA 2.2, the version with the highest functionality.



Due to the old versions of software tool STEP7 32-bit parameter values (e.g. total measuring range, software limit switches) have to be divided into high and low word. This is not necessary with the new STEP7 versions and our actual GSD file.

Example for the old GSD file:

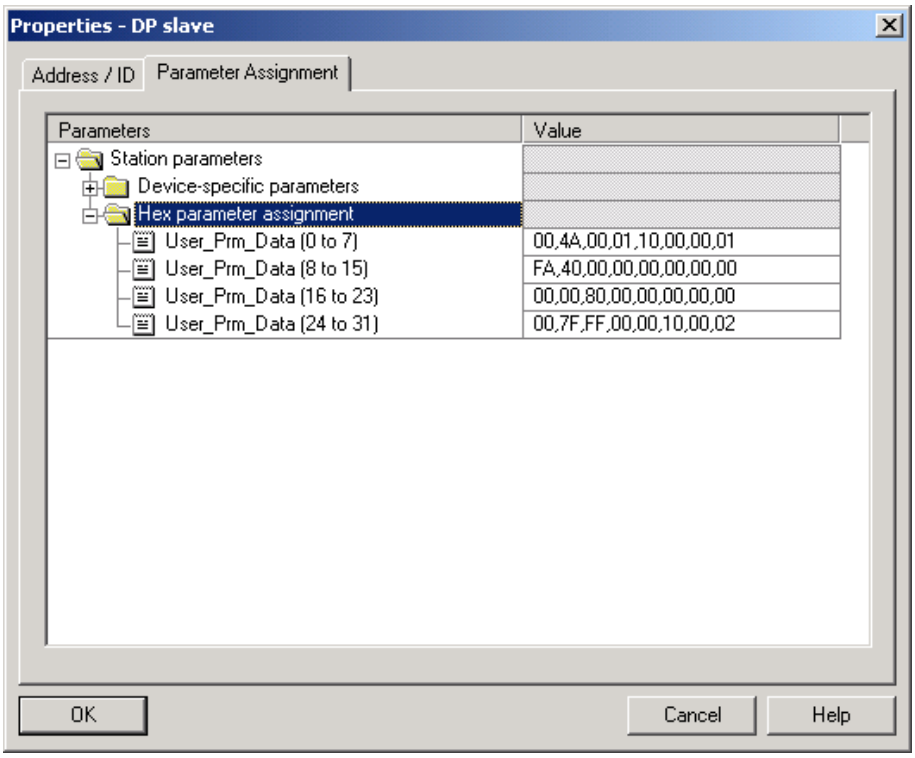
Decimal	**Hexadecimal**		**Hexadecimal**	**Decimal (to be entered)**
129600	00 01 FA 40	High word	00 01	1
		Low word	FA 40	64064

The decimal value „1“ has to be entered into the high word parameter field, the value 64064 into the low word parameter field.

Or:
Divide the value by 65536; enter the integer part of the result into the high word parameter field, the remainder into the low word field.

129600 / 65536 = 1.977539 → integer part = **1** → high word = 1
129600 – 1 x 65536 = 64064 → remainder = **64064** → low word = 64064

It is also possible to enter the parameters directly as hexadecimal code. However this is very complicated and it should be avoided if possible.


Properties - DP slave
Address / ID
Parameter Assignment
Parameters
Value
Station parameters
Device-specific parameters
Hex parameter assignment
User_Prm_Data (0 to 7)
00,4A,00,01,10,00,00,01
User_Prm_Data (8 to 15)
FA,40,00,00,00,00,00,00
User_Prm_Data (16 to 23)
00,00,80,00,00,00,00,00
User_Prm_Data (24 to 31)
00,7F,FF,00,00,10,00,02
OK
Cancel
Help

8 Technical Data

8.1 Electrical Data

General design	According to DIN VDE 0160 Protective Class III, degree of pollution 2, over voltage Category II
Power supply voltage	10 - 30 V DC (absolute limit values) *
Power drain	max. 2.5 Watt
Current consumption	max. 230 mA with 10 V DC, max. 100 mA with 24 V DC
EMC	Emitted interference according to EN 61000-6-4 Noise immunity according to EN 61000-6-2
Bus connection	Electrically isolated by optocouplers
Interface	Line driver according to RS 485
Baud rates	12 MBaud, 6 MBaud, 3 MBaud, 1.5 MBaud, 500 kBaud, 187.5 kBaud, 93.75 kBaud, 45.45 kBaud, 19.2 kBaud, 9.6 kBaud
Resolution	Standard: 4096 steps/revolution (optional up to 65536 steps/revolution)
Number of revolutions	1 (Singleturn) 4096 or 16384 (Multiturn)
Accuracy of division	± ½ LSB (up to 12 Bit), ± 2 LSB (up to 16 Bit)
Step frequency	max. 800 kHz
Code	Binary
Operating live	16,73 / 13,55 years (at 40°C, Single- / Multiturn, with connection cap)
$MTTF_d$	146521 h / 118694 h (at 40°C, Single- / Multiturn, with connection cap)
Addressing	Using rotary switches in the connection cap

*** Note**
The absolute angular encoder may only be operated with safety extra low voltage according to EN 50 178!

8.2 Certificates

UL proved	File E251481
RoHS	According EG-Direktive 2002/95/EG
Reach	Not affected
ISO 9001	

8.3 Mechanical Data

Housing	Aluminum, optional stainless steel
Lifetime	Dependent on shaft version and shaft loading – refer to table
Max. shaft loading	Axial 40 N, radial 110 N
Inertia of rotor	≤ 30 gcm^2
Friction torque	≤ 3 Ncm / ≤ 5 Ncm (without / with shaft sealing)
RPM (continuous operation)	Singleturn: max. 12,000 RPM
	Multiturn: max. 6,000 RPM
Shock (EN 60068-2-27)	≤ 100 g (halfsine, 6 ms)
Permanent shock (EN 60028-2-29)	≤ 10 g (halfsine, 16 ms)
Vibration (EN 60068-2-6)	≤ 10 g (10 Hz ... 2,000 Hz)
Weight (standard version)	Singleturn: ≈ 550 g
	Multiturn: ≈ 600 g
Weight (stainless steel version)	Singleturn: ≈ 1,100 g
	Multiturn: ≈ 1,200 g

Flange	**Synchro (S)**		**Clamp (C)**	**Hollow shaft (B)**
Shaft diameter	6 mm	10 mm	10 mm	15 mm
Shaft length	10 mm	20mm	20 mm	-
hollow shaft depth min. / max.	-	-	-	15 mm / 30 mm

Minimum (mechanical) lifetime

	Lifetime in 10^8 revolutions with F_a / F_r		
Flange	**40 N / 60 N**	**40 N / 80 N**	**40 N / 110 N**
C10 (Clamp flange 10 x 20)	247	104	40
S10 (Synchro flange 10 x 20)	262	110	42
S6 (Synchro flange 6 x 10) without shaft sealing	822	347	133

S6 (Synchro flange 6 x 10) with shaft sealing: max. 20 N axial, 80 N radial

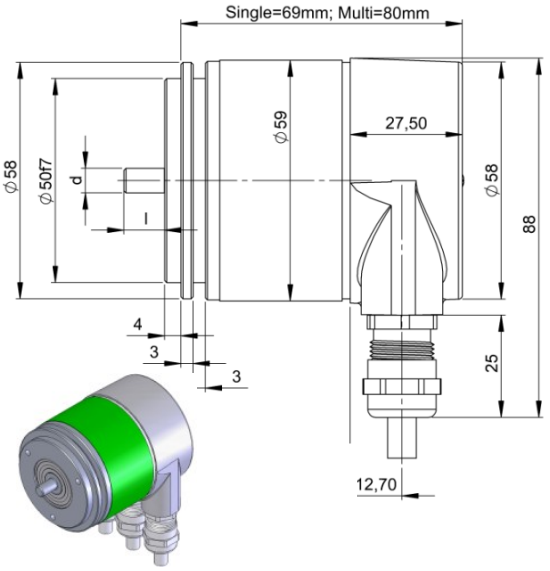
8.4 Environmental Conditions

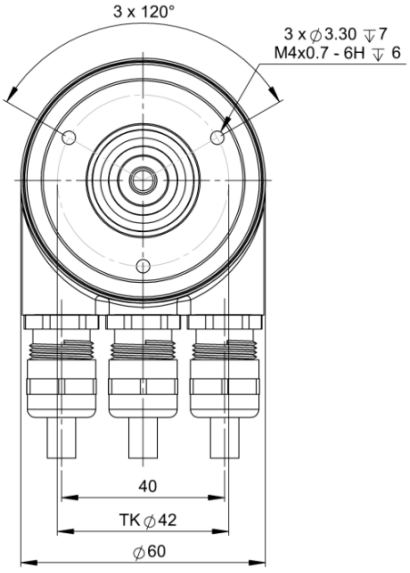
Operating temperature	− 40 .. +85°C
Storage temperature	− 40 .. + 85 °C
Humidity	98 % (without liquid state)
Protection class (EN 60529)	Casing side: IP 65
	Shaft side: IP 64 (optional with shaft sealing: IP66)

9 Dimensioned Drawings

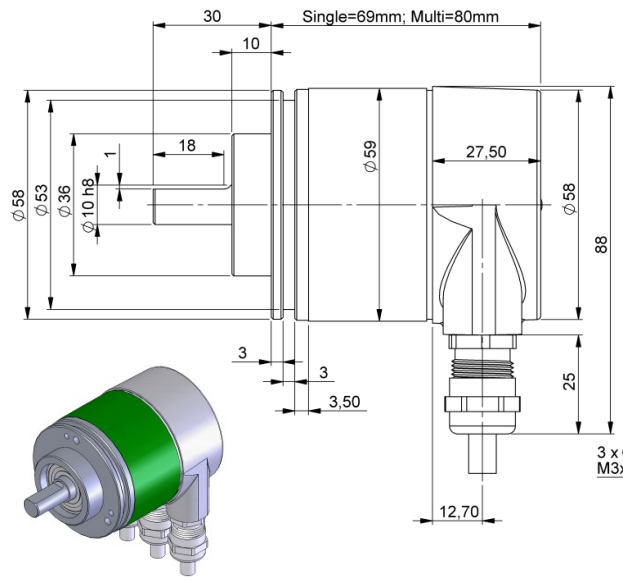
Synchro flange (S)
Available in 2 versions

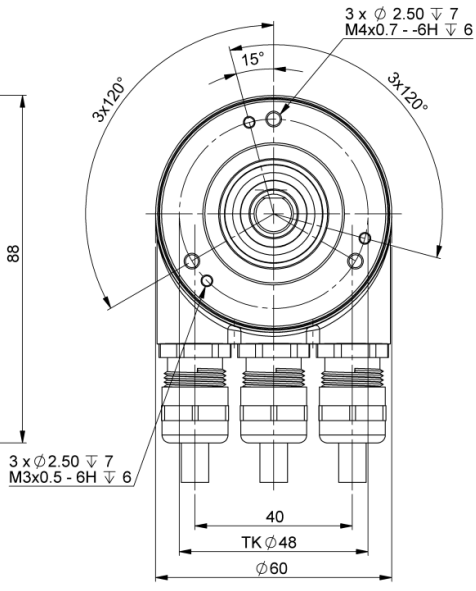
Synchro flange	d / mm	l / mm
Version S06	6_{f6}	10
Version S10	10_{h8}	20



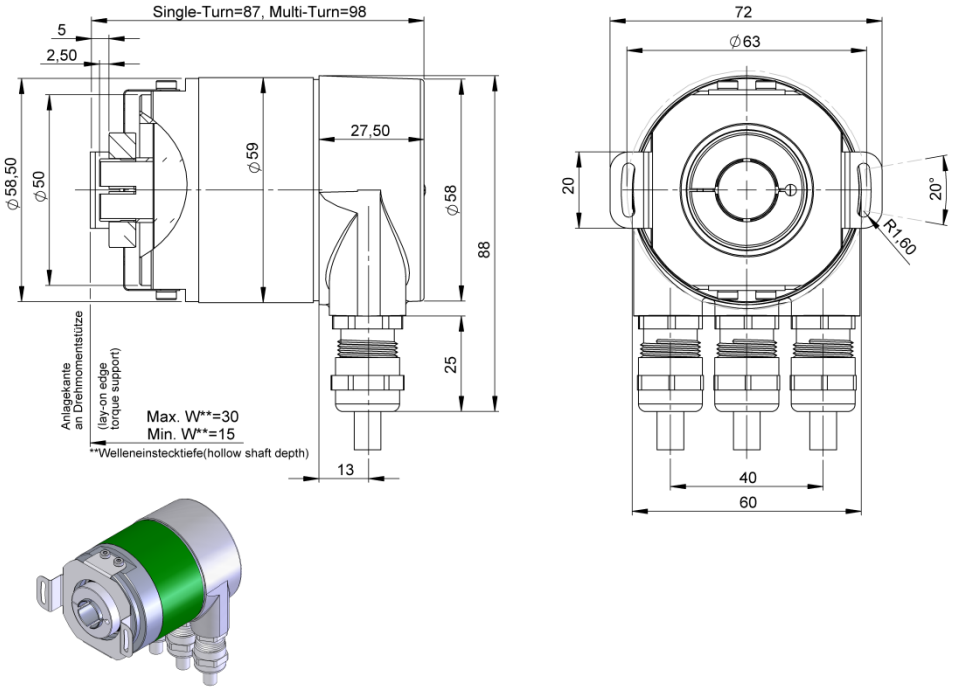


Clamp flange (C)





Hollow shaft (B)



Mounting instructions

The clamp ring may only be tightened if the shaft of the driving element is in the hollow shaft.

The diameter of the hollow shaft can be reduced to 12mm, 10 mm or 8 mm by using an adapter (this reducing adapter can be pushed into the hollow shaft).

Allowed shaft movements of the drive element are listed in the table.

	Axial	**Radial**
static	± 0.3 mm	± 0.5 mm
dynamic	± 0.1 mm	± 0.2 mm

10 Appendix

10.1 Type designation / ordering code

Description	Type Key								
Optocode	**OCD-**	DP	C1	B -	_ _	_ _ -	_ _ _	_ -	_ _ _
Interface	Profibus	**DP**							
Version			**C1**						
Code	Binary			**B**					
Revolutions (Bits)	Singleturn				**00**				
	Multiturn (4,096 revolutions)				**12**				
	Multiturn (16,384 revolutions)				14				
Steps per revolution	4,096 (0.09°)					12			
(Bits)	8,192 (0.04°)					**13**			
	65,536 (0.005°)					16			
Flange / Shaft Diameter	Clamp Flange, Full Shaft, ∅ 10 mm						**C10**		
	Synchro Flange, Full Shaft, ∅ 6 mm						**S06**		
	Synchro Flange, Full Shaft, ∅ 10 mm						S10		
	Blind Hollow Shaft, ∅ 15 mm						**B15**		
Mechanical options	Without							**0**	
	Shaft sealing (IP66)							S	
	Stainless steel version *							V	
	Customized							C	
Connection	With connection cap AH58-B1DP-3PG								**H3P**
	With connection cap AH58-B1DP-2M20								H2M
	With connection cap AH58-B1DP-072 (3x M12 Anschluss)								H3B
	Without connection cap **								HCC

Standard = bold, further models on request

Accessories and Documentation

Description	Article name	Article number
Aluminium housing with 3x M12 cable glands for cable diameters between 6,5 – 9 mm	AH 58-B1DP-3PG	0246370340
Stainless steel housing with 3x M12 cable glands for cable diameters between 6,5 – 9 mm	AH 58-B1DP-3PG-VA	0246370355
Aluminium housing with 3x M12 connectors	AH58-B1DP-072	0246370359
Aluminium housing with 2x M20 cable glands for cable diameter between 9 – 13 mm	AH 58-B1DP-2M20	0246370344
Shaft coupling ** Drilling: 10 mm / 10 mm Drilling: 6 mm / 6 mm	GS 10 GS 06	29100450 29100350
Clamp disc ** 4 pcs / encoder	SP 15	32400155
Clamp half-ring **2 pcs / encoder	SP H	32400152
Reducing Ring *** 15 mm auf 12 mm 15 mm auf 10 mm 15 mm auf 8 mm	RR12 RR10 RR8	32220291 32220292 32220295
GSD-File * Is necessary for the first installation	-	-
Installation / configuration manual for Profibus * German Englisch	 UMD-CXDP UME-CXDP	 - -

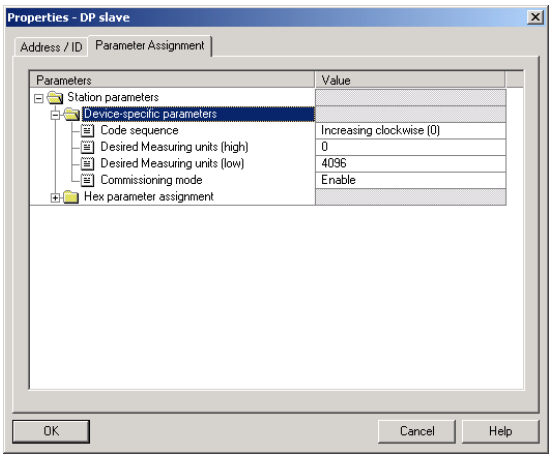
* These can be downloaded free of charge from our homepage www.posital.com.

** not for hollow shaft

*** only for hollow shaft

10.2 Further encoder configurations

The encoder versions described in the following are still supported for reasons of downward compatibility. They should not be used in new projects!



10.2.1 Version FRABA 2.0 Multiturn

This version differs from version 2.2 in the fact that there is a smaller number of parameters shown in the configuration tool.

10.2.2 Version FRABA 1.1 Multiturn

This is an older version formerly called Class „3“. It is similar to class 2 but has an additional velocity output. It is still available for reasons of downward compatibility but it should not be used for new projects.

10.2.3 Version FRABA 1.0 Multiturn

Output of position value and velocity without preset function. Should no longer be used.

10.2.4 Class 2 Multiturn ‚DX-Version’

Old version with reduced number of diagnostic data. Should only be used with older encoders with “DX” in the type key.

10.3 FAQ absolute encoder Profibus

Problem
There are problems with the Profibus network (bus error, no answer from the encoder) if one of the following Profibus masters is used:

- SIEMENS S5-95U
- Master Interface SIEMENS IM 308-B
- Softing PROFIboard
- Allen Bradley 1785 PFB/B
- Mitsubishi A1SJ 71PB92D

Possible cause
The masters do not support the full diagnostic data length (57 bytes).

Solution
If it is possible the maximum number of diagnostic data per slave should be increased in the master.
If this is not possible the encoder can either be used as a „class 1“ encoder (diagnostic data length 16 bytes) or one of the manufacturer-specific versions (FRABA 2.1 or 2.2) can be used with reduced diagnostics (cp. 5.1.5).

Problem
If COM PROFIBUS Version 5.0 is used it is not possible to insert the FRABA encoder into the hardware configuration if the PLC S5-95U is used.

Cause
The S5-95U does not support the full diagnostic data length (57 bytes). COM PROFIBUS V5.0 checks the GSD-parameter „Max_Diag_Data_Len=57“ and prevents the configuration of both devices together.

Solution
Use COM PROFIBUS Version 3.3, choose one of the manufacturer-specific FRABA-versions (FRABA 2.1 or 2.2) and activate the reduced diagnostics.
If COM PROFIBUS V5.0 is to be used the configuration of the FRABA encoder is only possible with a modified GSD file (slave key „Max_Diag_Data_Len“ has to be changed).

Problem
PLC and master are switched on, bus is active, but there is no answer from the encoder.

Possible solutions
First of all the state of LEDs in the connection cap should be checked (cp. section 6.3). Possibly this can give hints to the cause of the problem.
Both LEDs dark: Check power supply!

Both LEDs bright:
Encoder is ready but receives no configuration or parameter telegrams. Check the address setting in the connection cap. Check the connection of the bus lines (BUS IN / BUS OUT). Check the hardware configuration in your software tool.
Red LED bright, green LED flashing:
Parameter error! Check parameters, e.g. the rules for setting the total measuring range (cp. 4.1.6)

Problem
Sporadic bus errors

Possible cause
Terminating resistors not correct

Possible solution
Check terminating resistors!
The resistors of 220 Ω must be switched on at the beginning and at the end of the bus segment. Switch off the power supply and measure the resistance between the terminals A and B in the connection cap.
The resistance value must be about 110 Ω (220 Ω parallel 220 Ω).

Possible cause
EMC problems

Possible solutions
Is the used baud rate acceptable for the length of the bus lines? Try to use lower baud rate if necessary. Check the connection of the cable shield in the connection cap. Are all cables and conductions laid according to EMC rules?

10.4 Definitions

Address	A number, which is assigned to each node, no matter whether it is a master or slave. The address is set (non-volatile) in the connection cap using rotary switches.
AWC	Abbreviation: Absoluter Winkelcodierer (German) = Absolute Rotary Encoder
Baud rate	Data transfer rate specified as the number of bits transferred per second (baud rate = bit rate).
Bus Node	Device, which can send, receive or amplify data via the bus.
Configuring	When the master configures the slave the properties of the slave are specified (e.g. number of input and output bytes).
DDLM	Direct Data Link Mapper. Interface between Profibus-DP functions and the encoder software.
DDLM_Data_Exchange	Operating status of the bus, for standard data transfer.
DDLM_Set_Prm	Operating status of the bus, configuration and parameter are transmitted
„DDLM_Slave_Diag“	Operating status, diagnostic data are requested from the slave (e.g. encoder).
Diagnostics	Identification, localization, classification, display, additional evaluation of faults, errors and messages.
Freeze	This is a master command to the slave. This allows the master to freeze the states of the inputs (for example of the absolute angular encoder) to their current value. The input data are only updated again after reception of the UNFREEZE command.

GSD file	File that contains slave-specific characteristics. The GSD file is supplied by the manufacturer of the Profibus slave. The GSD format is standardized (defined in GSD specifications), so configuration tools of various manufacturers can use the GSD files.
Master	“Active” device in the network that can send data without request. Controls the data interchange.
Octet	Data unit of 8 bits = 1 byte
Profibus	Process Fieldbus, European Fieldbus standard, which is defined in the PROFIBUS Standard (EN 50170). This specifies functional, electrical and mechanical characteristics for a bit-serial Fieldbus system.
Slave	Bus node, that only sends data on request of the master. Absolute rotary encoders are always slaves.
Terminating resistor	Resistor that terminates the bus cable; terminating resistors are always required at the end of a cable or segment.
Type file	Similar to GSD file, is used with older configuration software tools.
Word	Expression used for a data unit of two bytes.

11 Index

B

Bus termination 5

C

Class 1 12
Class 2 12
Code sequence 13
Commissioning mode 24
Configuring the encoder 32
Connecting
  bus lines 6
  power supply 6
Connection cap
  settings 5

D

Data format 11
Desired measuring units 18
Diagnostic messages 27
Dimensioned Drawings 39

E

Electrical Data 37
Encoder configurations 10
  further 43
Endless operation 14
Environmental Conditions 38

F

FAQ 44

G

GSD file 46
  Installation 31

H

High word 35

I

Installation 5

L

LEDs 30
Low word 35

M

Mechanical Data 38
Memory error 28

O

Operating time warning 28
Ordering code 41

P

Parameter settings 12
Parameters 34
Physical impulses 17, 19, 21
Preset function 15
Preset value 26
Profibus Nutzerorganisation 4
Profile for Absolute Encoders 4

S

Shorter Diagnostics 20
Software-limit switch 20
Station address 5
Status bits 23
STEP 7 31

T

Teach-In Start 25
Teach-In Stop 25
Technical Data 37
Total measuring range 14
Type designation 41
Type file 46

V

Velocity
  Time base 22

12 Revision index

Revision	Date	Revision
Changed to new type key OCD-DPC, new technical drawings, new connection cap	9.4.2010	03/10 4.5
Changed drawings	3.9.2010	09/10 4.6
Cable gland changed, drawings in section 8.3 changed	9.12.2010	4.7